Differential Fertility in Sudan

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ABSTRACT

This study has been conducted in three selected areas in Sudan. The selected areas are broadly named the northern, the middle and the west of Sudan. In these three areas the investigated couples are 6085, 6685 and 5734, respectively totaling 18614 couples. The level of fertility in this study was measured by number of ever born children to one mother only. The average fertility levels of mothers in these three areas are [4.05±2.61], [4.46±2.78] and [4.51±2.66], respectively. The observed fertility level was significantly different. Thus it has been decided to use regression models of fertility on different socio-demographic variables observed in three different areas. Also, the fertility level of mothers was experiencing no child mortality [3.56±2.29]. The objectives of the analysis were to investigate the homogeneity of regression parameters in each case and also to investigate the homogeneity of regression lines. Different socio-demographic variables have differential impacts on fertility. The test of regression showed significant regional variations in the behavior of socio-demographic variables. There were 3076 child loss mothers and 15538 who have not loss any of their children. Differential behavior of socio-demographic variables of these two groups of mothers was also observed.

المستخلص

هذه الدراسة بنيت على بيانات جمعت من قبل الامم المتحدة ووزارة الصحة السودانية فى العام 2010 لدراسة وفيات الاطفال عن طريق الاستبيان المباشر للامهات فى عمر الانجاب (15–49) سنة. ولكي ندرس وفيات الاطفال لابد لنا من معرفة خصوبة الامهات فى هذه السن التي تقاس بقدرة الامهات على الانجاب بالنسبة للام الواحدة . جمعت هذه البيانات من جميع انحاء السودان من الشمالية وحتى جنوب السودان ولكن تم استبعاد البيانات الخاصة بجنوب السودان بعد الانفصال. وقسمت هذة المناطق الى ثلاث وهى : الشـــمال وتضم (كسلا – القضارف – البحر الاحمر – الشمالية– نهر النيل) وجمع منها 6085 اسـتبيان و منطقة الوسط و تشمل (الخرطوم – الجزيرة – سنار– النيل الابيض – النيل الازرق) او ما يعرف بقلب السودان و جمع منها 6685 استمارة وغرب السودان ويضم (شمال وغرب كردفان – شمال وغرب وجنوب دارفور) وجمع منها 5734 استبيان. الدراسة اثبتت ان متوسط انجاب الامهات للاطفال في الشمال [2.61±4.05] وفي وسط السودان [2.78 ±4.46] بينما فى غرب السودان هو [2.66±4.51]. اي ان اعلى معدل انجاب الاطفال فى السودان كانت فى منطقة غرب السودان ويلاحظ ان الاختلاف فى معدلات الانجاب ذات دلالة احصائية واضحة. ولهذا استخدم نموذج الانحدار لدراسة تأثير العوامل الديموغرافية واثرها فى زيادة او انخفاض معدلات الانجاب لدى الابوين كالتعليم ووظيفتيهما ونوع السكن ومكان السكن وعمرهما وسنهما عند الزواج وعدد افراد الاسرة و

العاملين من افراد الاسرة ونوع الامراض ووفيات الاطفال الرضع فى الاسرة وسن الامهات عند وفيات الاطفال ومكان الولادة ونوعية الخدمات التى توفرت للام فى هذه المناطق. هذه المتغيرات ذات دلالة غاية فى الاهمية. وهذه الدراسة مبنية على معرفة مدى تاثيرات هذه العوامل فى تلكم المناطق. واتضح من خلال نتائج هذه الدراسة ان هذه العوامل الديموغرافية لها تأثيرات متباينة. ومن ضمن هذه النتائج وجد ان 3076 أم قد تعرضن لفقدان طفل واحد على الاقل من ابنائهن بينما 15538 منهن لم يكن لديهن طفل متوفى. وهناك سلوك متباين للعوامل الديموغرافية بين اللاتى فقدن ابناءهن و اللاتى لم تكن لديهن تلك التجربة.

KEYWORDS: child death, Sudan statistics, infants.

INTRODUCTION

Fertility is influenced by a variety of interrelated factors such as education, occupation, duration of marriage, breast-feeding period, desired family size, child mortality socioeconomic status of parents, contraception use and so on.

Differences in the socio-cultural characteristics of parents have been observed to be associated with fertility differentials, and such socio-cultural characteristics as age at marriage, value of children, contraception and child mortality are reported to be influenced by education [1]. Moreover, the decision to have children and their number depends on the parents, particularly the mothers time is an important input in child bearing and rearing.

In many studies in both develop and developing countries, it has been observed that childbearing and rearing has economic consequences and that economic factors exert considerable influence on the reproductive decision of the couples.

Important factor witch influence fertility is contraceptive use. The couple plans their family size and executes the plan successfully to realize the desired number of children depending on their socioeconomic condition and contraception behavior [2].

Achieving small families is possible in a society where contraception is not prohibited, because without contraception, only education and socioeconomic condition cannot reduce fertility. In Sudan, contraception is not common, if not prohibited. Therefore, it was considered of interest to study the importance of socioeconomic variables in a society where couples have no experience of organized family planning programmers.

The specific objectives of the study then were: to study the fertility behavior of couples in relation to their socio-demographic characteristics, child loss experience, and the influence of factors affecting the fertility of those couples who had experienced child loss.

METHODOLOGY

This study was based on data collected from all over Sudan namely from North, Middle and West of Sudan. This area has 40 localities with 13,278,396 families. The selected areas were Northern, River Nile, Red sea, Kassala, Gadarief, Khartoum, Gezira, White Nile, Sinnar, Blue Nile, North Kordufan, South Kordufan, North Darfur, West Darfur and

South Darfur. In each state a two stage cluster sampling design was employed to draw a sample for the Sudan Household Health Survey-Second Round (SHHS2). Within each state, 40 census enumeration areas (EA) were selected. In case of these states, the EAs/clusters were distributed to urban and rural areas, proportional to the size of urban and rural populations in these states. Within each EA, a segment of 25 households was drawn randomly for survey. The sample was stratified by States and is not self-weighting. For reporting national and state-level results, sample weight was used.

Fifteen localities were selected by probability proportional to family size. There were 18614 families in the selected localities.

The data were collected by the United Nations (UN) and Ministry of Heath (Sudan). The data were collected by direct interviews. The information recorded included of ever born child (y, alive + dead + married), age of the mother (x_1, in completed years), the mothers educational level (x_2, in completed years of schooling), occupation of the mother (x_3; $x_3 = 0$ if housewife) age at marriage of mother (x_4, in completed years), educational level of the father (x_5, in completed years of schooling), occupation of the father (x_6, $x_6 = 0$, if teaching, $x_6 = 1$, if office work; $x_6 = 2$, if business; $x_6 = 3$, if farming), number of earning family members (x_7), period of breastfeeding (x_8, in months), socioeconomic status (x_{10}), number of family members (x_{11}), and duration of marriage (x_{12}).

The couples were categorized into the lower, middle and upper socioeconomic strata depending on the value of x_{10} being < 9, $9 \geq x_{10} \geq 14$, and ≥ 15 respectively. The value of x_{10} was given by the sum of the coded and encoded variables namely, ownership of number of television, cars, refrigerator; number of rooms in the house; type of house (0 = other, 1 = flat, 2 = independent house); availability of separate rooms for children (0 = no, 1 = yes); availability of carpets in all rooms (0 = no, 1 = yes).

Fertility differentials were analyzed in relation to their different socio-demographic characteristics [3]. The influence of factors affecting the fertility of couples who had experienced child loss was studied by fitting two regression lines of y on x's , one data from couples who had no child loss experience and the other for data from those who had had such experience. Explanatory variables were included in the regression model after investigating the presence of multicollinearity as suggested by Belsley et al. [2]. The included variables provided the minimum mean square error, minimum Cp values and maximum R^2 [3,4]. Before the model of fertility the regression model, the normality of fertility data was investigated by observing its standard values, where 95 percent of it lay between -2 and +2.

RESULTS and DISCUSSION

The respondent couples had, on an average, more than four children (4.34 ± 2.69). Over half (52 percent) had four or more children, 22.5 percent had four/five children, 33.6 percent had two/three children, and only 19 percent had one child or none.

Literacy and fertility

Table (1) presents the mean number of children even born to the couples by their educational level. The findings showed that almost three times as many wives (23.2 percent) as husbands (0.02 percent) were illiterate, and those who had primary, intermediate, secondary and higher education represented 16.3, 1.97, 6.3 and 2.7 percent, respectively. The

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corresponding percentage for the spouses was 17.3, 1.95, 2.4 and 1.6.

Table 1: Education of mother and number of ever born children

Level of education		Children ever born														Total
		1	2	3	4	5	6	7	8	9	10	11	12	13	16	
Illiterate	n	0	1	1	0	0	2	0	0	0	0	0	0	0	0	4
	%	0	0.25	0.25	0	0	0.50	0	0	0	0	0	0	0	0	1.00
Primary	n	568	533	446	349	316	282	200	138	103	59	27	16	0	0	3037
	%	9.9	9.3	7.8	6.1	5.5	4.9	3.5	2.4	1.8	1.0	0.5	0.3	0	0	53.2
Intermediate	n	27	33	44	49	53	53	51	23	20	10	2	1	1	0	367
	%	0.5	0.6	0.8	0.9	0.9	0.9	0.9	0.4	0.4	0.2	0	0	0	0	6.4
Secondary	n	257	264	199	165	134	72	54	13	10	4	3	1	1	0	1177
	%	4.5	4.6	3.5	2.9	2.3	1.3	0.9	0.2	0.2	0.1	0.1	0	0	0	20.6
University/HI	n	170	136	96	50	29	12	10	5	1	1	0	0	0	0	510
	%	3.0	2.4	1.0	0.9	0.5	0.2	0.2	0.1	0	0	0	0	0	0	8.9
Adult education	n	7	14	15	19	5	9	11	9	7	1	4	1	0	0	102
	%	0.1	0.2	0.3	0.3	0.1	0.2	0.2	0.2	0.1	0	0	0	0	0	1.8
Khalwa	n	55	73	63	68	47	49	46	32	26	25	15	7	5	1	512
	%	1.0	1.3	1.1	1.2	0.8	0.9	0.8	0.6	0.5	0.4	0.3	0.1	0.1	0	9.0
All	n	1084	1054	864	700	584	479	372	220	167	100	51	26	7	1	5709
	%	19.0	18.5	15.1	12.3	10.2	8.4	6.5	3.9	2.9	1.8	0.9	0.5	0.1	0	100.0

The findings further indicated that illiterate couples had more than nine ever born children (9.95 ± 1.84), and that there was a sharp decrease in fertility with an increase in their educational level. This was more pronounced in the case of the wives. Thus, fertility differential by each level of the wives' education were significantly different: P ($F \geq 173.57$) = 0.000 with 4 and 18599 d.f; DMRT values were ($D_2 = 0.53$, $D_3 = 0.57$, $D_4 = 0.56$, $D_5 = 0.57$). However, illiterate and primary educated husbands had similar numbers of ever born children ($D_2 = 0.66$, $D_3 = 0.68$, $D_4 = 0.69$, $D_5 = 0.71$, P ($F > 64.90 = 0.00$ with 4 and 18647 df).

Occupation and fertility

The occupation of both spouses was considered to influence adoption of the small family norm. Women working outside the home are less likely to expose themselves to the risk of pregnancy, and hence an upwards movement in occupational patterns results in a downward shift in fertility. The data showed that the wives in our sample were, by and large, housewives.

Age of wife and fertility

The women's age influences fertility in that early marriage increases her reproductive span, and in the absence of contraception, can result in many children. Table (2) presents disruption of the couples by the age of the wife and the number of the children ever born.

Table 2: Disruption of the couples by age of women and ever born children

Age of women	Children ever born													Total
	1	2	3	4	5	6	7	8	9	10	11	12	13$^+$	
< 20	0.73	0.21	0.06	0.009	0.00	0.002	0.0	0.0	0.00	0.00	0.00	0.0	0.00	466
20-34	0.19	0.22	0.19	0.15	0.10	0.07	0.04	0.02	0.007	0.002	0.001	0.0	0.00	5899
≥35	0.05	0.06	0.09	0.11	0.13	0.130	0.13	0.11	0.090	0.06	0.030	0.02	0.005	4475
All	1665	1695	1546	1374	1184	1026	816	585	442	259	148	74	26	10840

In our sample, the average age of the women (wives) was 28.18 years (SD ± 0.88); the majorities (63.4%) were in their late childbearing ages, 54.7% were again in their peak childbearing years (20-34 years), and only 18.5 %of women were below the age of 20 years. This pattern of less childbirth among the middle-age groups of women and more childbirth among older women may be attributed to late marriage; the average age at marriage was 18.42±4.37 years (Table 2). A bad proportion (1.6 percent) of the women had married between 15-18 years of age, but the majorities (5.2 percent) were married at 35 years of age or later. The findings also showed a sharp decrease in fertility with an increase in the age at marriage.

The woman's age at marriage was significantly associated with her educational attainment [P (F ≥ 276.01) = 0.000 with 12 and 18594 d.f.], and simultaneous increase in the educational level and age at marriage also decreased fertility significantly [P (F ≥2.79) = 0.000

with 16 and 18592 d.f.**]**. These findings suggested that fertility can be lowered to some extent even without practicing family planning by increasing the age at marriage of women and simultaneously providing employment outside the home.

Breast-feeding and fertility

Theoretically, the effect of inter-birth interval and breast-feeding were closely related. On the one hand a conception shortly after birth can trigger hormonal reactions leading premature reduction of milk secretion, thus ending the breast-feeding period. On the other hand prolong lactation induces longer postpartum amenorrhea thereby increasing the likelihood of longer intervals between birth. Surveys conducted in develop and developing countries have confirmed that birth intervals and breast-feeding are closely related and shorter breastfeeding duration results in higher fertility levels[4].

The findings indicated that about three-fourth (76.2 percent) of the mothers had breast-feed their children. The average duration of breast-feeding was around one year (11.26 ± 2.94). Surprisingly, fertility was found to increase, though not significantly, [P (F $\geq$ 0.21) = 0.81) = 0.000 with 2 and 18249 d.f.], with an increase in the duration of breast-feeding.

However, a simultaneous increase in breast-feeding duration and the mother's age at marriage had a lowering effect on the number of children ever born [P (F $\geq$ 2.30) = 0.019 with 8 and 18237 df.]. It was also observed that the duration of breast-feeding decreased significantly with an increase in the mother's educational level and thus, educational did not help fertility reduction.

Socioeconomic status and fertility

In some developing countries, fertility has been observed to decline with improvement in socioeconomic conditions. As illustrated in Table (3), 62.3 percent of the couples were from the middle socioeconomic category and had about four (4.34 ± 2.69) ever born children. About 46 percent had more than the average number of children who accounted for 66 percent of all ever born children. Most of the couples (69.2) who belonged to the higher socioeconomic categories had 15.7 percent of all ever born children. The differential in fertility according to socioeconomic condition was highly significant [P (F $\geq$ 47.11) = 0.000 with 2 and 18249 d.f.] suggesting thereby that the decision to have children and the number of children ever born depends on the economic conditions of parents.

Table 3: Mean and standard deviation (S.D.) of child loss by socioeconomic

status and parity

Socioeconomic status		Parity							All
		≤1	2	3	4	5	6	≥7	
Penny less	Mean	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
	S.D.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	

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	n	0.00	0.00	0.00	0.00	0.00	0.00	0.00	7774
	%								
Poorest	Mean	0.05	0.11	0.24	0.34	0.44	0.60	1.34	
	S.D.	0.22	0.35	0.51	0.64	0.68	0.90	1.52	
	n	270	274	319	290	240	207	487	2087
	%	12.9	13.1	15.3	13.9	11.5	9.9	23.3	
Second	Mean	0.06	0.15	0.24	0.38	0.48	0.76	1.49	
	S.D.	0.24	0.39	0.53	0.72	0.53	1.02	1.51	
	n	347	356	343	330	260	250	562	2448
	%	14,2	14.5	14.0	13.5	10.6	10.2	22.9	
Middle	Mean	0,04	0.14	0.24	0.39	0.45	0.69	1.51	
	S.D.	0.21	0.38	0.49	0.71	0.72	0.93	1.51	
	n	381	402	323	252	258	261	568	2445
	%	15.6	16.4	13.2	10.3	10.6	10.7	23.2	
Fourth	Mean	0.05	0.09	0.24	0.27	0.36	0.46	1.05	
	S.D.	0.21	0.32	0.53	0.51	0.66	0.64	1.37	
	n	343	342	271	252	323	167	434	2032
	%	16.9	16.8	13.3	12.4	15.9	8.2	8.2	
Richest	Mean	0.04	0.03	0.12	0.17	0.30	0.30	0.85	
	S.D.	0.19	0.18	0.35	0.43	0.60	0.56	1.10	
	n	324	321	290	250	203	141	299	1828
	%	17.7	17.6	15.9	13.7	11.1	7.7	16.4	
All	Mean	0.05	0.11	0.22	0.32	0.41	0.60	1.30	
	S.D.	0.21	0.34	0.49	0.63	0.71	0.89	1.46	
	n	1665	1695	1546	1374	1184	1026	2350	10840
	%	15.3	15.6	14.3	12.7	10.9	9.4	21.7	100

Child mortality and fertility

Child mortality has substantial positive impacts on fertility [5-7]. Since the probability of infant survival is low in developing countries, parents tend to have more children than actually desire in the hope that some, at least, would survive into adulthood.

The present study indicated that (16.5 percent) of the investigated couples had lost one child and 6.7 percent had experienced multiple child loss. Table (4) illustrates the distribution of the couples by their experience of child-loss. Women who had also experienced child loss had also experienced a greater number of pregnancies. Thus, 9.9 percent of the women who had lost only one child had more than the average number of children. The corresponding percentage among those who had lost two children was much lower 3.9 percent, while among women without any child loss experience, it was much higher (83.5 percent).

Table 4: Distribution of women by socioeconomic status and number of child-loss

Socioeconomic condition	Child-loss										Total	%	Mean	S.D.
	0	1	2	3	4	5	6	7	8	10				
Penny less	100.0	0	0	0	0	0	0	0	0	0	1440	0.08	0.00	0.00
Poorest	76.2	14.0	6.0	2.0	1.0	0.4	0.3	0.1	0	0	2719	0.15	0.41	0.91
Second	76.6	13.0	6.0	2.7	1.0	0.4	0.3	0	0	0	3450	0.19	0.42	0.93
Middle	78.5	12.1	5.1	2.3	1.3	0.4	0.1	0.1	0	0	3675	0.20	0.38	0.89
Fourth	86.0	9.1	3.1	1.0	0.4	0.2	0.1	0	0	0	3626	0.19	0.22	0.67
Richest	91.2	6.4	1.6	.5	.2	.1	0	0	0	0	3704	0.19	0.12	0.46
Total	15538	1838	730	289	128	51	29	7	2	2	18614	1.00	1.72	0.44
%	83.5	9.9	3.9	1.6	0.7	0.3	0.2	0	0	0	1.00			

Couples who had multiple child loss experience had ten or more ever born children (10.97), or twice as many compared to couples who had no such experience (5.14). The differential in fertility by child mortality was highly significant [P (F $\geq$ 66.12) = 0.000 with 7 and 18244 df]. Again, analyzing child loss data by the parent's education level indicated that although education had an adverse effect on fertility, it did not prevent couples with child loss experiences from replacing their lost children.

Regression analysis

Broadly classifying the variables, fertility was found to very significantly with changes in all the socioeconomic factors

studied except the duration of breastfeeding. However, all the variables were not significantly influential in explaining variations in fertility of the

two categories of couples – those who had suffered child loss and those who had not. The selected variables and their coefficients are presented in (Table 5).

Table 5: Regression results

Parameters	Estimates	Standard error of estimates	t-value	*p*-value
β_1	2.630	0.523	5.03	0.000
β_2	0,219	0.010	22.534	0.000
β_3	-0.365	0.056	6.465	0.000
β_4	-0.229	0.018	12.811	0.000
β_5	-0.170	0.058	2.931	0.003
β_6	-0.238	0.088	2.713	0.066
β_7	0.125	0.067	1.867	0.062
β_8	1.003	0.071	14.209	0.000
β_9	0.426	0.103	4.131	0.000

$R^2 = 0.69$

The fitted regression line is highly significant [P (F ≥ 60.75) = 0.000 with 7 and 1809 d.f.]. The explanatory variation could explain 49.2 percent of the variation in fertility. The analysis indicates that maternal education and age at marriage reducing effects on fertility. Among families with child loss experience, the father's education and occupation did not affect the fertility reduction. This is in agreement with previous results [8].

Improvement in socioeconomic status resulted in upwards fertility among both groups of couples, and fertility was further enhanced by this variable among

couples who had experienced child loss. Further, while the number of learning members in the family had a positive impact on enhancing fertility, this was not true in the case of families who had suffered child loss.

CONCLUSIONS

In a bid to reduce fertility, studies relating to its social determinants have been a major preoccupation of national planners. Among the social determinants, education, female employment and family planning have a fertility-lowering effect. Adoption behavior is positively associated with education. However, very

little is known about the social determinant of fertility in a society where couples are not familiar with contraceptive use. In this paper an attempt has been made to identify the social determinants which influence fertility in Sudan where the people are economically not well-off, the climatic condition is hot throughout the year, medical facilities are not free for every family, the literacy rate is high among both males and females, but there is no concept of family planning adoption.

The investigating couples were, by and large, educated. All of the women were housewives. The couples mainly belonged to the middle socioeconomic group. They had completed 18.25 ± 7.93 years of married life, and had, on an average, more than four ever born children (the majority had four or fewer children). However, only 45.8 percent had more than the average family size and accounted for 66 percent of all ever born children. Maternal education played a significantly role in decreasing fertility.

Other important factors which showed differentials in fertility when women's employment status, age at marriage experience and the husband's education and occupation .His involvement in more economic activities resulted in an upward trend in fertility and thus socioeconomic status and fertility were in the same upward direction. Simultaneous increase in the women's age at marriage and breastfeeding duration can go a long way in decreasing fertility.

A positive fertility was also observed between fertility and child mortality: couples who had experienced multiple child loss had, on an average, ten or more births, and even education flied to prevent the higher fertility associated with child loss.

Differential impact of the socio-demographic variable was observed from the regression lines of fertility of women who had experience child loss and those who had not. A study of regression lines for the two groups of women separately, showed that their education and age at marriage had a reducing effect on fertility.

For both groups, fertility tended to increase due to an increase in socioeconomic status. The father's education and occupation did not influence the fertility of the child loss group. The findings of our study indicated that, even without contraception increasing the level of education and age at marriage and providing opportunities for women to work outside the home can go a long way in decreasing fertility.

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